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DDPOPHM/USA/DDO/NADTR91111

PERFORMANCE ORIENTED PACKAGING TESTING
OF
POLYSTYRENE FOAM CONTAINER
FOR

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NOV 19 1991
S C D

VARIOUS MARINE SMOKE AND ILLUMINATION SIGNALS

AUTHOR:

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Performing Activity:

Naval Weapons Support Center Crane
Crane, Indiana 47522-5000

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FINAL

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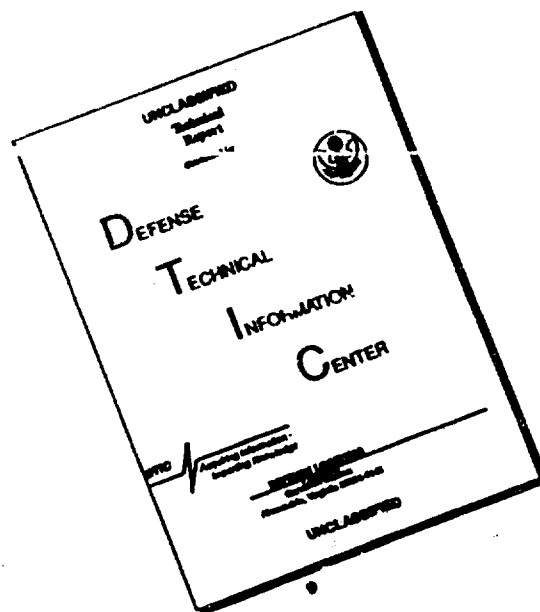
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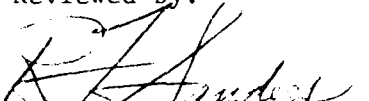


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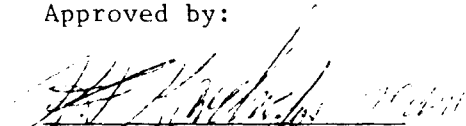
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19 ABSTRACT (Continue on reverse if necessary and identify by block number) Qualification tests were performed to determine whether the polystyrene foam container, for various Marine Smoke and Illumination Signals, meets the Performance Oriented Packaging (POP) requirements specified by the United Nations Recommendations on the Transportation of Dangerous Goods. The container loaded to a gross weight of 42 pounds successfully met the requirements and retained its contents throughout the test.					
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INTRODUCTION

The polystyrene foam container designed for shipping and storage of four Marine Smoke and Illumination Signals, (Figure 1) was tested to ascertain whether this container would meet the requirements of Performance Oriented Packaging (POP) as specified by the United Nations (UN) Recommendation on the Transportation of Dangerous Goods, Document ST/SG/AC.10/1, Revision 6, Chapters 4 and 9. A Base Level Vibration Test was also conducted in accordance with the rulings specified in the Department of Transportation's (DOT) Performance Oriented Packaging Standards Federal Register/Vol. 55, No. 246/Friday, December 21, 1990. The objectives were to evaluate the adequacy of the container in protecting the Marine Smoke and Illumination Signal, as well as to evaluate the container's ability to protect personnel involved with handling and shipping the container.

TESTS PERFORMED

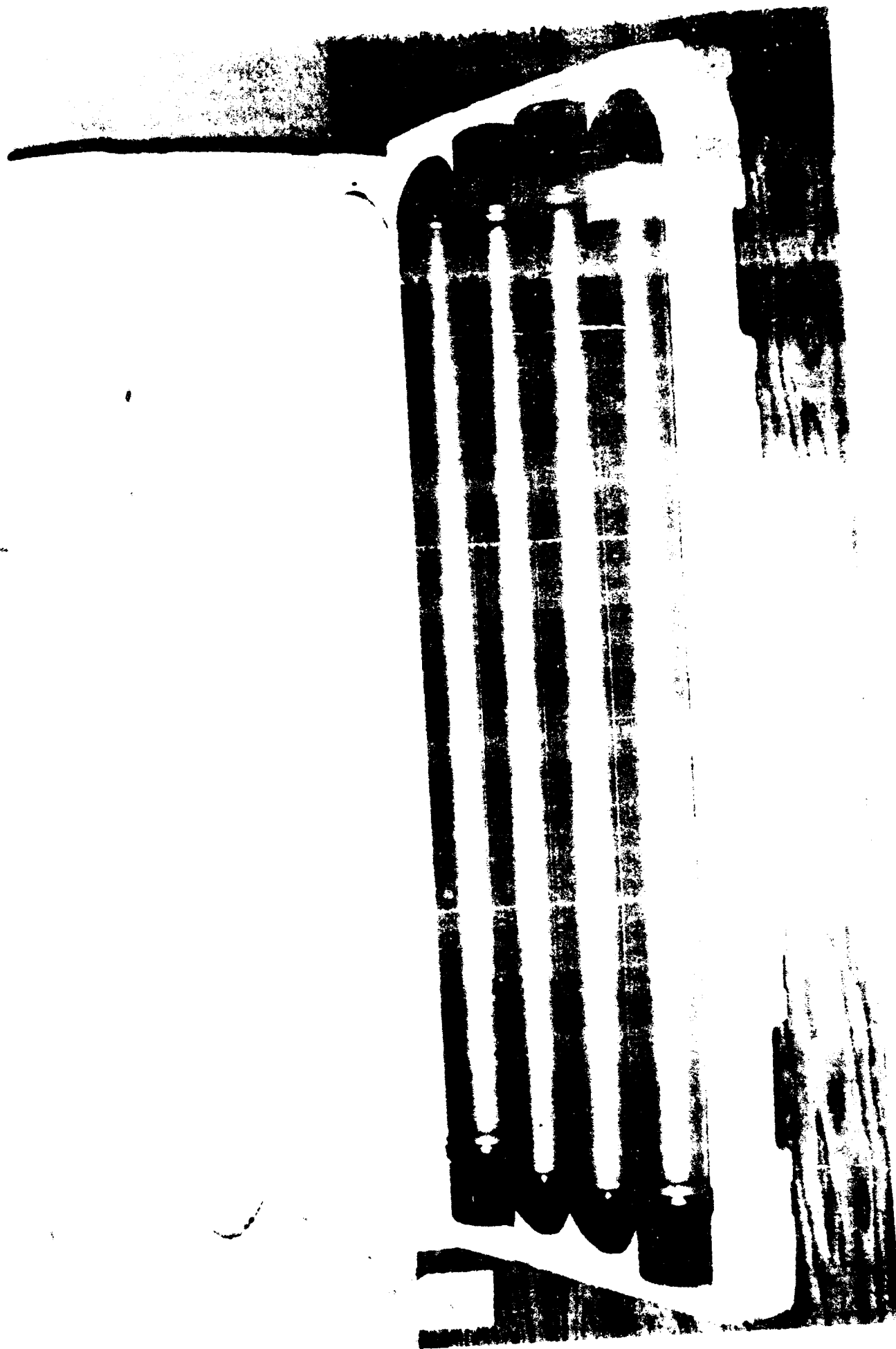
1. Stacking Test

This test was performed in accordance with ST/SG/AC.10/1, Chapter 9, Paragraph 9.7.6. Three different containers were used, and subjected to a stack weight of 1,360 pounds on each container. To ensure that the container, rather than the signal would sustain the load, empty containers were used for the test. The test was performed on three empty containers for a period of 24 hours. After the allowed time, the weight was removed and the containers examined. Any deterioration, or distortion which could adversely affect transport, reduce strength or cause instability in stacks of packages was considered cause for rejection. The containers were measured and examined before and after the test and found capable of supporting the simulated load of like containers stacked 16 feet high. There was no deformation or compression of the containers.

2. Drop Test

This test was performed in accordance with ST/SG/AC.10/1 Chapter 9, Paragraph 9.7.3. Five containers were used for the test. Each container was subjected to a total of five drops; four flat drops and one corner drop. The drops were performed from a height of 4 feet in the following sequence:

- a. Flat Bottom
- b. Flat Top
- c. Flat on Long Side
- d. Flat on Short Side
- e. One Corner



This test was performed at ambient, $+70^{\circ} + 20^{\circ}$ F temperature. The contents of the container should be retained within its packaging and exhibit no damage liable to affect safety during transport.

3. Base Level Vibration Test

This test was performed in accordance with Appendix C to Part 173 of Federal Register/Vol. 55, No. 246/Friday, December 21, 1990/Final Rule. Three sample containers were loaded with four inert Marine Smoke and Illumination Signals to a gross weight of 42 pounds and closed for shipment. The three containers were placed on a vibrating platform that had a vertical amplitude (peak-to-peak displacement) of one inch. The containers were not restrained during vibration except by a fence attached to the test surface to prevent them from falling off the table. The containers were tested for 60 minutes in their normal shipping position. The vibratory input to the container was at a frequency that caused the container to be raised from the vibrating platform to such a degree that a piece of material of approximately 1/16" (1.6mm) thickness could be passed between the bottom of the container and the platform.

PASS/FAIL (UN CRITERIA)

The criteria for passing the stacking test is outlined in Paragraph 9.7.6.3 of ST/SG/AC.10/1 and states the following: "No test sample should show any deterioration which could adversely affect transport safety or any distortion liable to reduce its strength or cause instability in stacks of packages".

The criteria for passing the drop test is outlined in Paragraph 9.7.3.5 of ST/SG/AC.10/1 and states the following: "Where a packaging for solids undergoes a drop test and its upper face strikes the target, the test sample passes the test if the entire contents are retained by an inner packaging or inner receptacle (e.g., a plastic bag), even if the closure is no longer sift-proof".

PASS/FAIL (49 CFR CRITERIA)

The criteria for passing the Base Level Vibration Test is outlined in Appendix C of Part 173 Performance Oriented Packaging Standards, Federal Register/Vol. 55, No. 246/Friday, December 21, 1990/Final Rule and states the following: "Immediately following the period of vibration, each package shall be removed from the platform, turned on its side and observed for any evidence of leakage. Rupture or leakage from any of the packages constitutes failure of the test".

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Justification	
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Availability Co	
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TEST RESULTS

1. Stacking Test

Satisfactory.

2. Drop Test

Satisfactory.

3. Base Level Vibration Test

Satisfactory with no leakage.

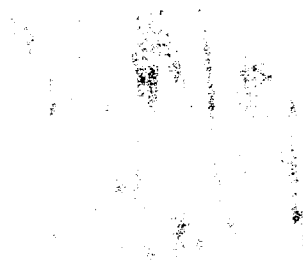
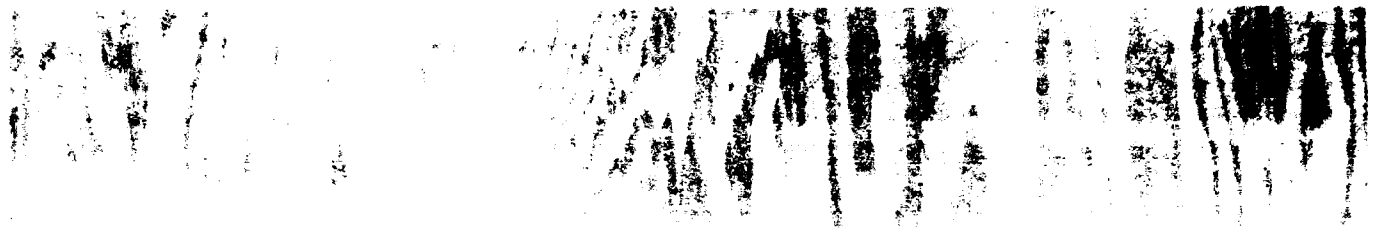
DISCUSSION

1. Stacking Test

Three different containers were used, and subjected to a stack weight of 1,360 pounds on each container. To ensure the container, rather than the Marine Smoke and Illumination Signal would sustain the load, empty containers were used for the test. The test was performed on the three empty containers for a period of 24 hours. The container was measured and examined before and after the test and found capable of supporting the simulated load of like containers stacked 16 feet high. There was no leakage, distortion, crushing, or deterioration to any of the containers as a result of this test. In September 1964 a stacking test was also conducted on various other polystyrene foam containers developed by NWSC Crane. Each container was loaded to the equivalent concentrated load simulating a stack 16 feet high varying from 2.0 pounds/square inch (psi) to 3.5 psi. Additional information on this study can be obtained from an earlier POP test report on the MK 58 Marine Location Marker Container, DODPOPHM/USA/DOD/NADTR91105 dated March 1991.

2. Drop Test

Container number 1 was subjected to a flat drop on the bottom and inspected for any damage which would be a cause for rejection. Since there was no evidence of damage, the same container was subjected to three additional flat drops on the top, long side and the short side without damage. The container was then subjected to a corner drop from a height of four feet. There was some evidence of compression on the impacted corners as shown in Figure 2, but there was no cracking or failure of the container. The container was not damaged in any way by the test. The other containers were then loaded and subjected to the same five drops from a height of four feet without damaging the container or the contents.



3. Vibration Test

Immediately after the vibration test was completed, each container was removed from the platform, turned on its side and observed for any evidence of leakage. The tape remained intact, the seals were not broken, and there was no evidence of leakage or damage to the contents or the container.

4. General

Polystyrene containers of the type described in this test report have been used for ordnance and pyrotechnic packaging for the past 27 years. The adequacy of protection and safety afforded by these plastic foam containers has been a subject of much discussion during that period of time. Such discussion continues in the present time frame as well, but all available records and known instances of use clearly indicate that polystyrene containers have always done an excellent job of item protection and personnel safety. In addition, they have always provided the most cost-effective packaging. The tensile test associated with the polystyrene foam containers used for pyrotechnics (see NWSC/CR/RDTN-185 in references) has forced the manufacturers to maintain quality in their molding procedure and the container itself has allowed the Navy to come as close to the ideal package as possible. That is, a container that weighs nothing, costs nothing and takes up no space. The price of the Marine Smoke and Illumination Signal container has risen since 1964, but it still represents only a small percent of the cost of the item. The additional weight it adds is also only a small percent of the overall weight. It does add to the overall cube, but even this is less than most wood containers would require.

REFERENCE MATERIAL

United Nations "Recommendation on the Transportation of Dangerous Goods", ST/SG/AC.10/1, Revision 6

49 CFR, Part 107, et al. Performance Oriented Packaging Standards, Federal Register/Vol. 55, No. 246/Friday, December 21, 1990, Final Rule

Applied Science Department Report NWSC/CR/RDTN-185 on Development and Evaluation of MK 25 MOD 4 Marine Location Marker Container, 15 January 1985, U. S. Naval Weapons Support Center, Crane, Indiana

DODPOPHM/USA/DOD/NADTR91105, Performance Oriented Packaging Testing of MK 58 Marine Location Marker Container

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TEST DATA SHEET

CONTAINER: Polystyrene Foam Shipping and Storage Container for Various Marine Smoke and Illumination Signals

Type: 4H1

UN Code: 1.3G

Specification Number:
MIL-P-19644

Material:
Polystyrene foam

Gross Weight:
20 kg
(44 pounds)

Dimensions:
1.06 m (L) x .43 m (W) x .14 m (H)
(41.88" L x 16.75" W x 5.5" H)

Closure (Method/Type):
Glass filament
Reinforced Tape

Tare Weight:
18.16 kg
(40 pounds)

Additional Description: SHIPPING AND STORAGE CONTAINER,
consisting of identical container halves, Drawing 3139747

PRODUCTS: Marine Smoke and Illumination Signal

MK 66 MOD 1, L266, 1370-01-112-7404
MK 117 MOD 1, L269, 1370-01-112-7405
MK 118 MOD 1, L271, 1370-01-112-7406
MK 120 MOD 0, L259, 1370-01-045-0477
MK 121 MOD 0, L260, 1370-01-045-0478

Proper Shipping Name:

MK 66 MOD 1 - Ammunition, Illuminating
MK 117 MOD 1 - Ammunition, Illuminating
MK 118 MOD 1 - Ammunition, Illuminating
MK 120 MOD 0 - Cartridges, Signal
MK 121 MOD 0 - Signals, Distress

United Nations Number:

MK 66 MOD 1 - 0254 MK 120 MOD 0 - 0054
MK 117 MOD 1 - 0254 MK 121 MOD 0 - 0195
MK 118 MOD 1 - 0254

United Nations Packing Group: II

Physical State: Solid | Amount Per Container: Four (4)

Net Weight:

MK 66-1 14.53 kg (32 pounds) MK 120-0 14.71 kg (32.4 pounds)
MK 117-1 14.53 kg (32 pounds) MK 121-1 14.71 kg (32.4 pounds)
MK 118-1 14.53 kg (32 pounds)

TEST PRODUCT:

Name: Inert MK 66 MOD 1 Marine Smoke and Illumination Signals
Physical State: Solid
Size: .08 m Dia x .99 m L (3.00" Dia x 39.00" L)
Quantity: Four (4) Dunnage: None
Weight of Four (4): 18.16 kg (40 pounds)

SUPPLEMENTARY

INFORMATION

ERRATA

TEST DATA SHEET

CONTAINER: Polystyrene Foam Shipping and Storage Container for Various Marine Smoke and Illumination Signals	
Type: 4H1	UN Code: 1.3G
Specification Number: MIL-P-19644	Material: Polystyrene Foam
Gross Weight: 20 kg (44 pounds)	Dimensions: 1.06 m (L) x .43 m (W) x .14 m (H) (41.88" L x 16.75" W x 5.5" H)
Closure (Method/Type): Glass filament Reinforced Tape	Net Weight: 18.16 kg (40 pounds)
Additional Description: SHIPPING AND STORAGE CONTAINER, consisting of identical container halves, Drawing 3139747	
PRODUCTS: Marine Smoke and Illumination Signal MK 66 MOD 1, L266, 1370-01-112-7404 MK 117 MOD 1, L269, 1370-01-112-7405 MK 118 MOD 1, L271, 1370-01-112-7406 MK 120 MOD 0, L259, 1370-01-045-0477 MK 121 MOD 0, L260, 1370-01-045-0478	
Proper Shipping Name: MK 66 MOD 1 - Ammunition, Illuminating MK 117 MOD 1 - Ammunition, Illuminating MK 118 MOD 1 - Ammunition, Illuminating MK 120 MOD 0 - Cartridges, Signal MK 121 MOD 0 - Signals, Distress	
United Nations Number: MK 66 MOD 1 - 0254 MK 117 MOD 1 - 0254 MK 118 MOD 1 - 0254 MK 120 MOD 0 - 0054 MK 121 MOD 0 - 0195	
United Nations Packing Group: II	
Physical State: Solid Amount Per Container: Four (4)	
Net Weight: MK 66-1 14.53 kg (32 pounds) MK 120-0 14.71 kg (32.4 pounds) MK 117-1 14.53 kg (32 pounds) MK 121-1 14.71 kg (32.4 pounds) MK 118-1 14.53 kg (32 pounds)	
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